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(54) **BIOMETRIC CERTIFICATES**

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(51) **Int. Cl.**[7] **G06K 9/00**

(52) **U.S. Cl.** **382/115**; 382/116; 382/232

(58) **Field of Search** 382/116, 115, 382/156, 232; 380/4, 23, 25, 30, 49; 705/39; 340/146.3, 5.82, 5.6, 5.65, 5.86; 341/155

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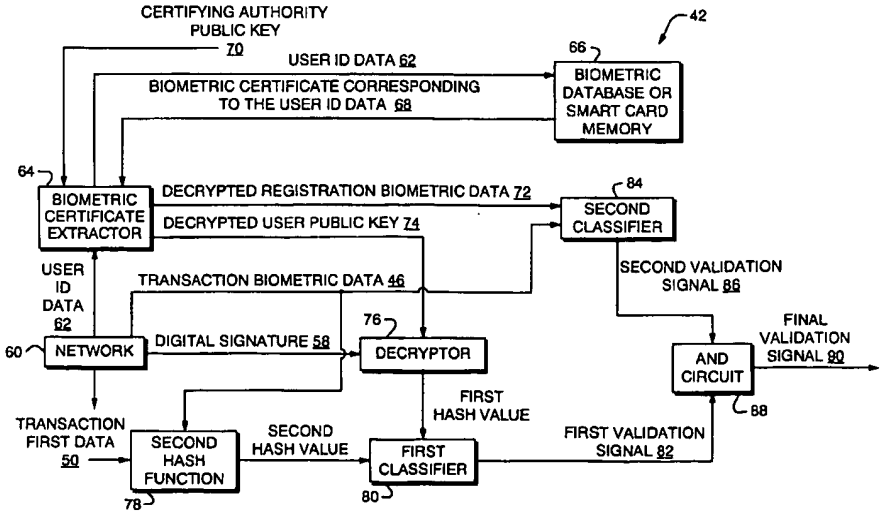
(57) **ABSTRACT**

Biometric identification is combined with digital certificates for electronic authentication as biometric certificates. The biometric certificates are managed through the use of a biometric certificate management system. Biometric certificates may be used in any electronic transaction requiring authentication of the participants. Biometric data is pre-stored in a biometric database of the biometric certificate management system by receiving data corresponding to physical characteristics of registered users through a biometric input device. Subsequent transactions to be conducted over a network have digital signatures generated from the physical characteristics of a current user and from the electronic transaction. The electronic transaction is authenticated by comparison of hash values in the digital signature with re-created hash values. The user is authenticated by comparison against the pre-stored biometric certificates of the physical characteristics of users in the biometric database.

10 Claims, 5 Drawing Sheets



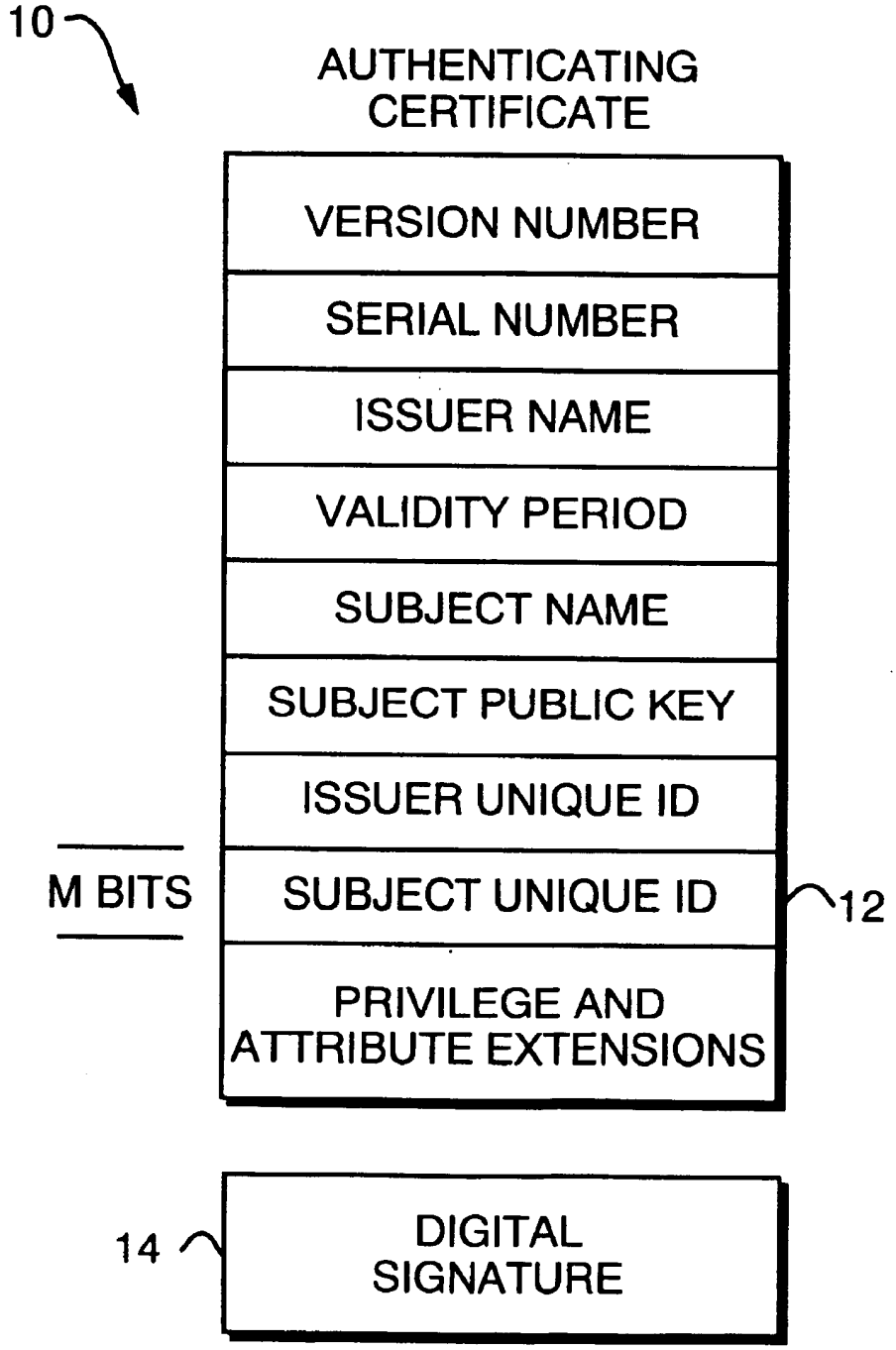


FIG. 1
(PRIOR ART)

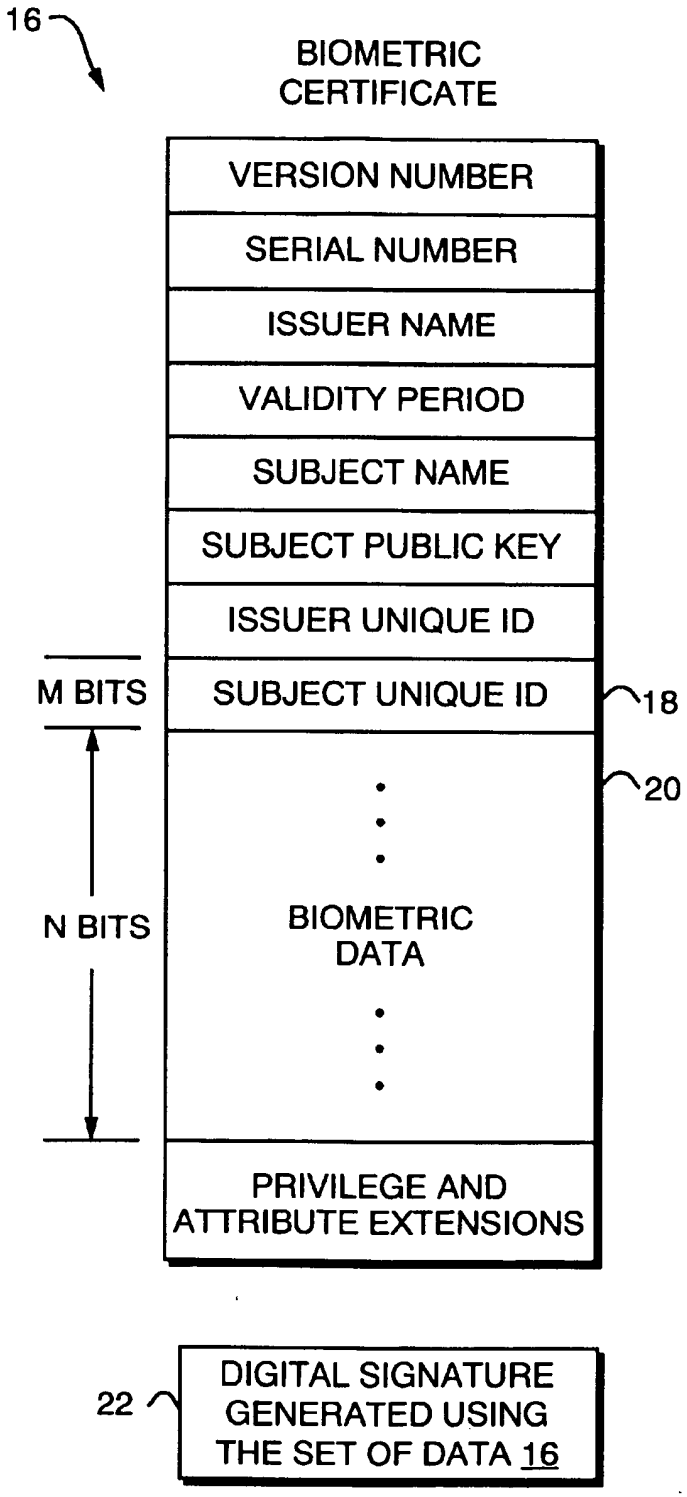

16
BIOMETRIC CERTIFICATE
VERSION NUMBER
SERIAL NUMBER
ISSUER NAME
VALIDITY PERIOD
SUBJECT NAME
SUBJECT PUBLIC KEY
ISSUER UNIQUE ID
M BITS
SUBJECT UNIQUE ID
18
20
N BITS
BIOMETRIC DATA
PRIVILEGE AND ATTRIBUTE EXTENSIONS
22
DIGITAL SIGNATURE GENERATED USING THE SET OF DATA 16

FIG. 2

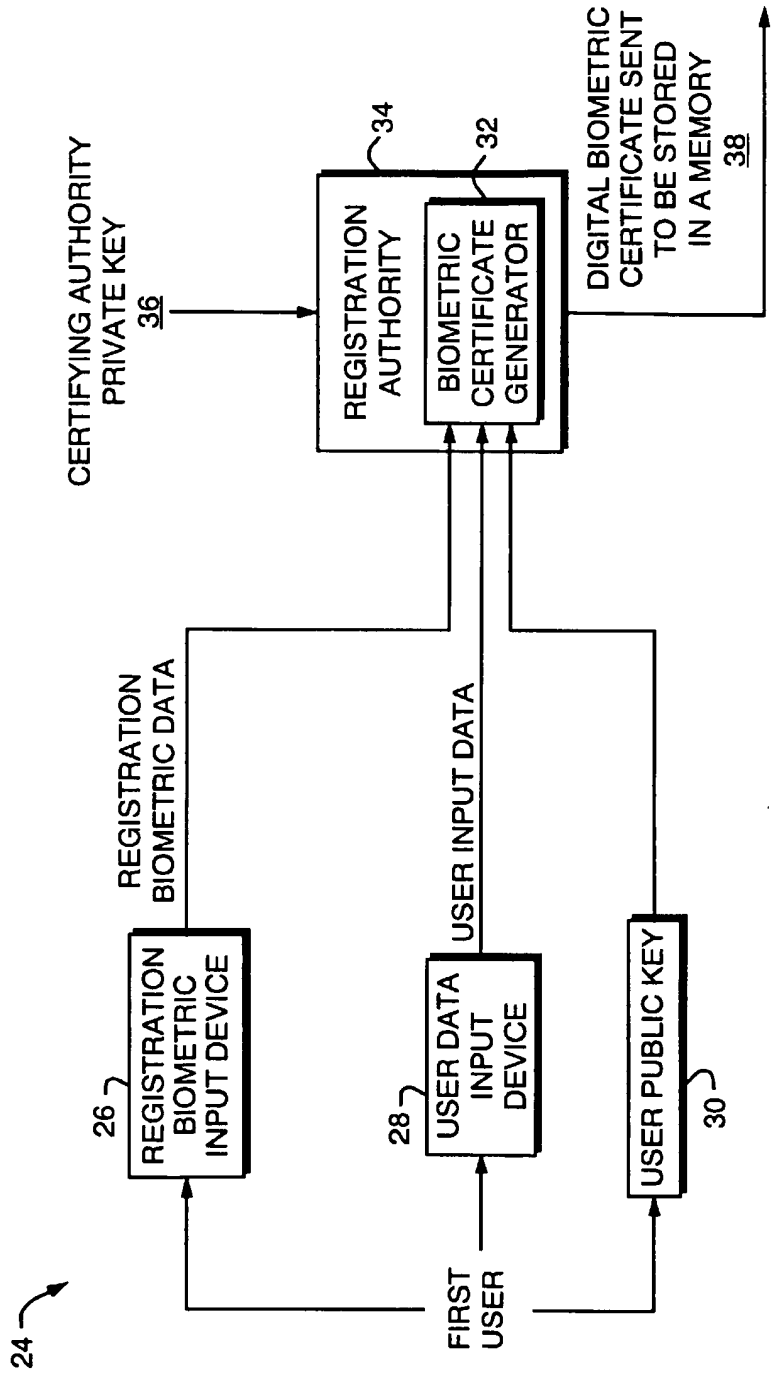

CERTIFYING AUTHORITY PRIVATE KEY 36
REGISTRATION AUTHORITY
34
BIOMETRIC CERTIFICATE GENERATOR
32
DIGITAL BIOMETRIC CERTIFICATE SENT TO BE STORED IN A MEMORY 38
REGISTRATION BIOMETRIC DATA
USER INPUT DATA
REGISTRATION BIOMETRIC INPUT DEVICE
26
USER DATA INPUT DEVICE
28
USER PUBLIC KEY
30
FIRST USER
24

FIG. 3

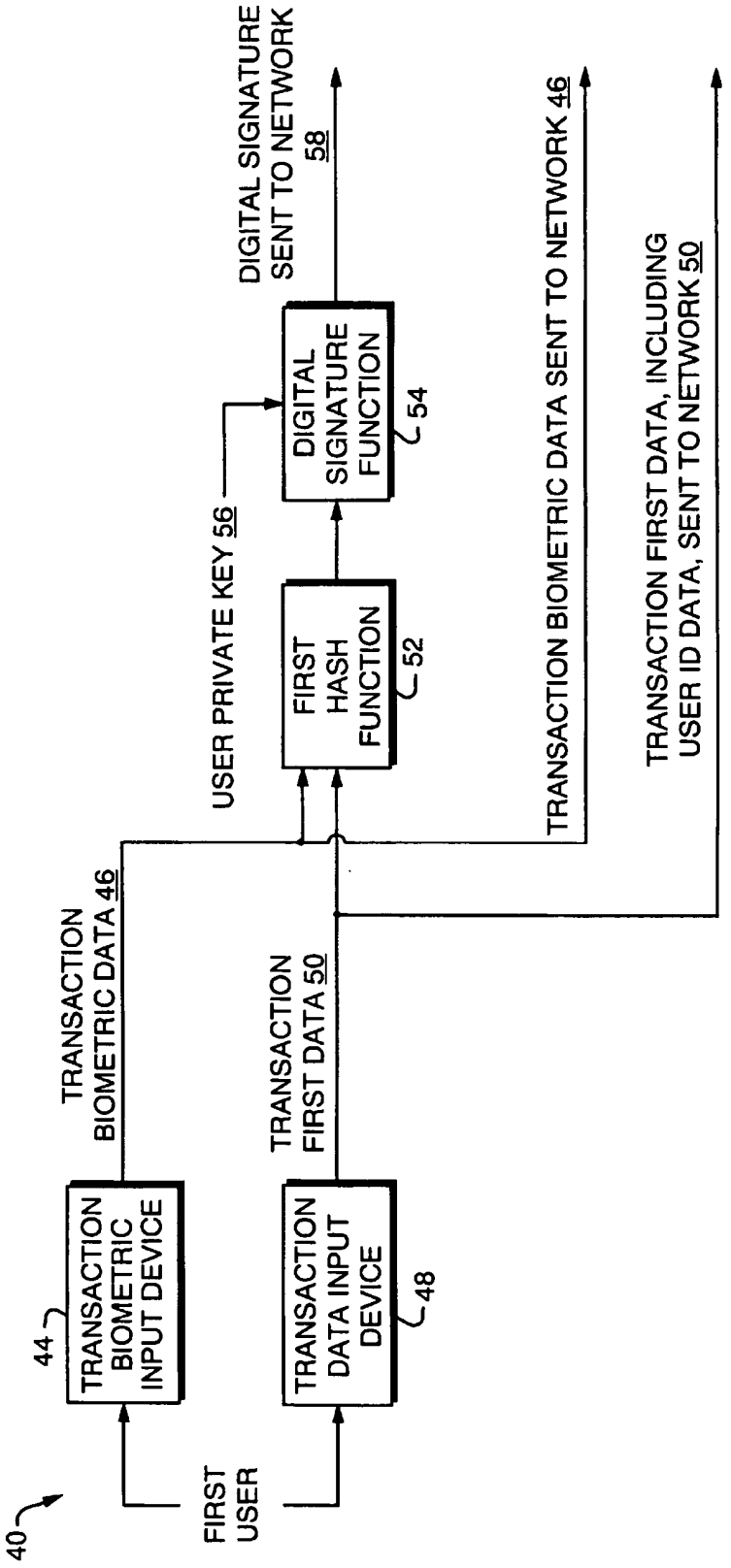

40
FIRST USER
44
TRANSACTION BIOMETRIC INPUT DEVICE
48
TRANSACTION DATA INPUT DEVICE
TRANSACTION BIOMETRIC DATA 46
TRANSACTION FIRST DATA 50
USER PRIVATE KEY 56
FIRST HASH FUNCTION 52
DIGITAL SIGNATURE FUNCTION 54
DIGITAL SIGNATURE SENT TO NETWORK 58
TRANSACTION BIOMETRIC DATA SENT TO NETWORK 46
TRANSACTION FIRST DATA, INCLUDING USER ID DATA, SENT TO NETWORK 50

FIG. 4

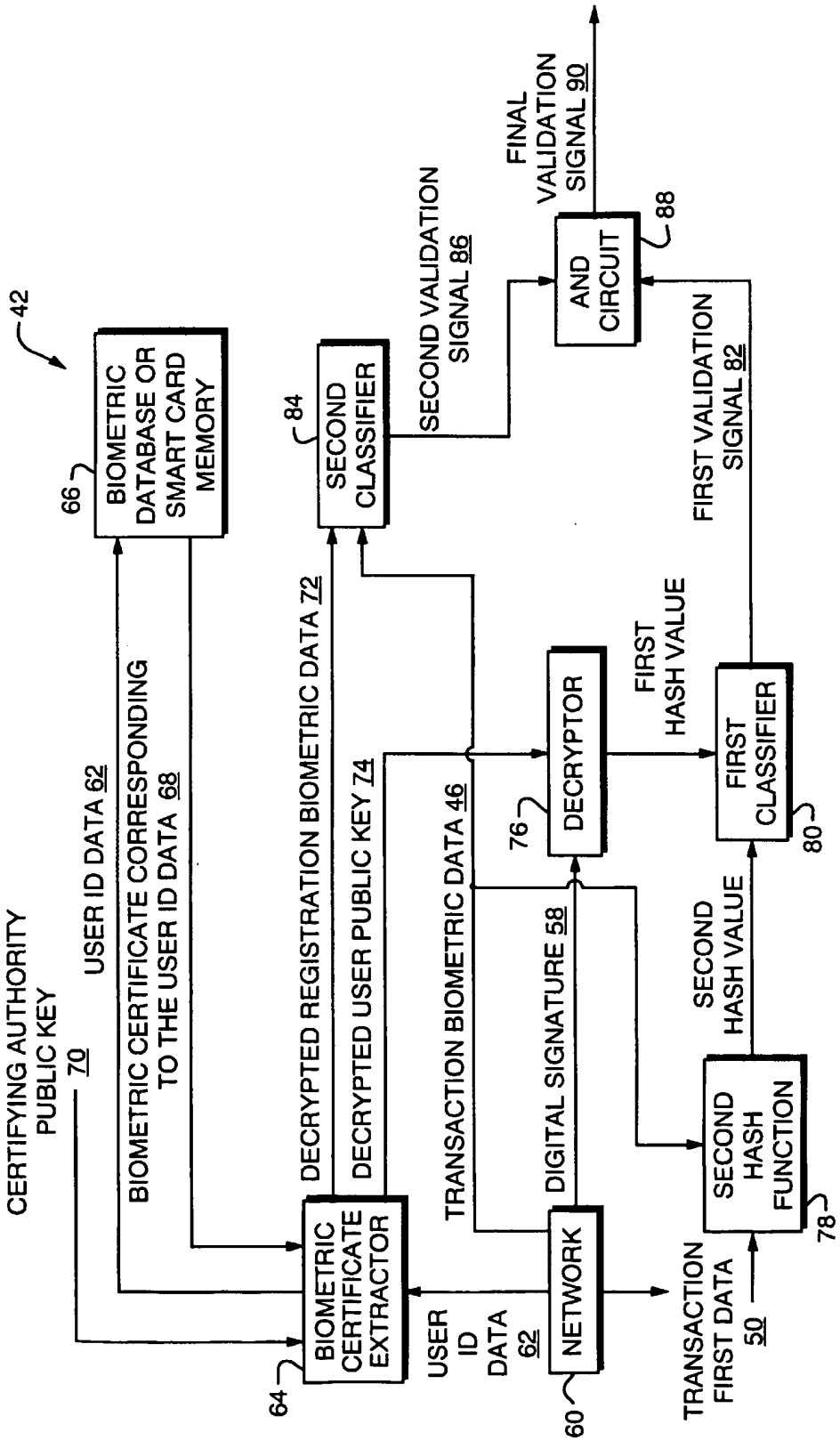

42
BIOMETRIC DATABASE OR SMART CARD MEMORY
66
SECOND CLASSIFIER
84
SECOND VALIDATION SIGNAL 86
AND CIRCUIT
88
FINAL VALIDATION SIGNAL 90
FIRST VALIDATION SIGNAL 82
CERTIFYING AUTHORITY PUBLIC KEY 70
USER ID DATA 62
BIOMETRIC CERTIFICATE CORRESPONDING TO THE USER ID DATA 68
DECRYPTED REGISTRATION BIOMETRIC DATA 72
DECRYPTED USER PUBLIC KEY 74
TRANSACTION BIOMETRIC DATA 46
DIGITAL SIGNATURE 58
DECRYPTOR
76
FIRST HASH VALUE
FIRST CLASSIFIER
80
SECOND HASH VALUE
SECOND HASH FUNCTION
78
BIOMETRIC CERTIFICATE EXTRACTOR
64
USER ID DATA 62
NETWORK
60
TRANSACTION FIRST DATA 50

FIG. 5

BIOMETRIC CERTIFICATES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority under 35 USC §119 of provisional application 60/046,012 filed May 9, 1997, the entire disclosure of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This disclosure relates generally to the field of secure communications, and in particular to the issuance and management of certificates for authenticating messages.

2. Description of Related Art

The use of computer networks and telecommunication systems for various transactions has markedly increased in recent years. Traditional transactions such as shopping, purchasing, banking, and investment services have experienced growth in new directions due to the application of computers and telecommunications.

While traditional transactions have heretofore been conducted typically on a person-to-person basis, many telecommunication-based transactions are conducted remotely and sight-unseen; i.e. the participants in telecommunication-based transactions may never meet.

With such telecommunication-based transactions, there is an increasing need to recognize and verify the authenticity of a remote user of electronic services, including such services involving consumers of all types of electronic transactions such as purchases over the Internet, home banking, electronic transfers of funds, and electronic brokerage services. Such electronic transactions may also involve users of remote repositories of data, for example, to access classified records, medical records, billing records, and unclassified but sensitive data, such as company records. Other relevant areas requiring adequate or even absolute security include authentication of signers of electronic documents such as contracts. In general, any electronic service of value, provided over a local network or a public network, requires authentication of the requester in order to protect the value of the service. More valuable services typically require a greater degree of authentication.

Historically, access to electronic services has been provided through identification techniques such as account names and authentication techniques such as personal identification numbers (PINs) and passwords. Such authentication techniques have not proven to be very secure since PINs and passwords are often easily guessed, hard to remember, or subject to discovery by exhaustive automated searches. Recently, digital certificates have emerged as a leading candidate for authenticating electronic transactions.

Ideally, a digital certificate, such as those defined by the X.509 and ANSI X.9 standards, allows users or buyers and sellers to authenticate electronic documents and electronic transactions in a manner analogous to the authentication of documents by a Notary Public in person-to-person transactions. The combination of cryptographic techniques, including public key cryptography, and the use of digital certificates provides greater integrity, privacy and a degree of authentication for on-line electronic transactions which instills a greater level of confidence in the electronic services consumer.

For example, such authenticating certificates in the prior art may be generated by concatenating a message and a

public key with a set **10** of data as shown in FIG. **1**, which may be in a sequence and which may include a subject unique ID **12** corresponding to the subject; that is, the individual or entity such as a corporation, having the public key. As shown in FIG. **1**, other fields in the set **10** of data may include a version number, a serial number for the certificate with respect to a sequence of generated certificates, the name of the issuer, a validity period to determine an expiration of validity of the certificate, a subject name identifying the user or individual sending the transaction, an issuer unique ID number, and other data extensions indicating privileges and attributes of the certificate, such as access privileges.

The subject unique ID **12** of the user may include M bits representing, for example, a social security number or a password associated with the user sending the transaction. Typically, M≈50 bits≈6bytes or less.

The authenticating certificate, being the concatenation of the set **10** of data with the public key and the transaction data, is then processed, for example, using a hash function such as a one-way hashing function, to generate a hashed value. The hashed value is then signed; that is, encrypted, using the private key of the user to generate a digital signature **14**. The digital signature **14** is then appended to the authenticating certificate and the message, such as an electronic transaction,for transmission over, for example, a network.

The X.509 and ANSI X.9 standards described above incorporate a hash function to generate unique digital signatures **14** from a respective set **10** of data. Such one-way hashing functions enable the transaction data to be computationally infeasible to derive solely from the hash value.

While the use in the prior art of authenticating certificates incorporating digital certificates improves transactions employing electronic authentication, it still falls short of actually authenticating a human transactor, such as a consumer. Instead, such digital certificates in the prior art only authenticate the private cryptographic key used in the transaction or signature. Since private keys are physically stored on computers and/or electronic storage devices, such private keys are not physically related to the entities associated with the private keys. For example, a private key is assigned to an entity, which may be a group of people, an organization such as a company, or even groups of organizations, and so private keys are not limited to actual human individuals.

Identification indica of individuals may be subdivided into three broad categories: indica based on the physical characteristics of the individual, that is, what the individual is; indicia based on one's knowledge, such as passwords known to the individual; and indicia based on assigned information, that is, what another individual has associated with the identified individual, or what the identified individual chooses with which to be associated. The first category having physical indicia relates to the biometric data of an individual, and includes characteristic features such as genetic composition, fingerprints, hand geometry, iris and retinal appearance, etc., which are unique to each individual, with known exceptions such as the identical genetic compositions of twins.

The second and third categories having known and/or assigned indicia includes information which the individual knows and/or is charged with memorizing and divulging for authentication, such as social security number, mother's maiden name, access codes such as long distance calling card numbers, and personal passwords. The second category also includes information and/or objects which the indi-

vidual owns and/or is charged with carrying and divulging for authentication, such as driver's licenses and passports.

Private keys are assigned indicia. Accordingly, the lack of physical identification of a human transactor with a private key is a flaw in authentication techniques in the prior art using such private keys. Other authentication and security techniques in the prior art are similarly flawed, since many authentication and security techniques rely on identification indicia of the second category.

Techniques are known in the art for authenticating an individual based on identification indica of the first category; that is, by physical characteristics. For example, U.S. Pat. No. 4,641,349 to Flom et al. discloses a system for performing iris recognition. Typically, such physical characteristics identifying techniques require complicated computational operations for the capture and accurate classification of physical characteristics, since such physical characteristics are unique to each individual. Accordingly, the identification indicia for such physical characteristics generally requires a relatively large amount of memory to store and classify such identification indicia.

Heretofore, the relatively large computational demands of authentication techniques based on physical characteristics has prevented such authentication techniques from being implemented in electronic transactions.

SUMMARY OF THE INVENTION

It is recognized herein that biometric identification and classification in the authentication of electronic transactions provides for increased security and accuracy.

A biometric certification system and method are disclosed herein which implements an end-to-end security mechanism binding the biometric identification of consumers with digital certificates. The biometric certification system authenticates electronic transactions involving a user, and includes a biometric input device which responds to a set of physical characteristics of the user, and generates corresponding first biometric data related to the physical condition of the user.

Biometric data is pre-stored as biometric certificates in a biometric database of the biometric certificate management system by receiving data corresponding to physical characteristics of registered users through a biometric input device. Subsequent transactions to be conducted over a network have transaction biometric data generated from the physical characteristics of a current user, which is then appended to the transaction first data, and which then authenticates the user by comparison against the pre-stored biometric data of the physical characteristics of users in the biometric database.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the disclosed biometric certification system and method are readily apparent and are to be understood by referring to the following detailed description of the preferred embodiments of the present invention, taken in conjunction with the accompanying drawings, in which:

FIG. **1** illustrates an authenticating certificate in the prior art;

FIG. **2** illustrates a biometric certificate of the disclosed biometric certification system and method;

FIG. **3** illustrates a biometric certificate registration apparatus;

FIG. **4** illustrates an electronic transaction transmission section; and

FIG. **5** illustrates an electronic transaction reception and processing section.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring in specific detail to the drawings, with common reference numbers identifying similar or identical elements, steps, and features, as shown in FIG. **2** the present disclosure describes a biometric certification system and method for generating biometric certificates from a set **16** of data, including a subject unique ID **18** and biometric data **20**. A digital signature **22** generated using data set **16** is then appended to the data set **16** to form the biometric certificate, as shown in FIG. **2**.

The disclosed biometric certification system is shown in FIGS. **3–5**, having biometric registration section **24** shown in FIG. **3**, a transmitting section **40** shown in FIG. **4**, and a receiving section **42** shown in FIG. **5**. The biometric registration section **24** processes user biometrics and associated inputs to generate biometric certificates which are unique to the user, and which are stored in a memory such as a biometric database and/or a smart card memory. Once such biometric certificates are stored, a first user may conduct biometrically-secured electronic transactions sent from the transaction transmission section **40** of FIG. **4** to the transaction reception section **42** of FIG. **5**, at which the electronic transaction is authenticated and processed.

Referring to FIG. **3**, the registration section **24** has a set of input devices, including a registration biometric input device **26** and a user data input device **28**. The biometric input device **26** generates registration biometric data from the physical characteristics of the user, such as fingerprints, hand geometry, iris and retinal appearance, and speech patterns.

The registration biometric input device **26** may include visual cameras and/or other visual readers to input fingerprints, hand geometry, iris appearance, and retinal appearance. For example, companies such as IDENTIX, FUJITSU, and AUTHENTEC provide such equipment for reading fingerprints, while RECOGNITION SYSTEMS provides equipment to read hand geometry. EYE-DENTIFY is an example of a company which provides retinal imaging devices, while IRISCAN and SENSAR are examples of companies which provide iris imaging devices.

Alternatively, the registration biometric input device **26** may be adapted to receive audio characteristics of a user. For example, a microphone in conjunction with a speech digitizer may be used to receive and digitize speech. Such companies as BBN, T-NETIX, and ALPHA-TEL provide such equipment for receiving and digitizing speech to generate corresponding biometric data.

Biometric input devices known in the art may be used to receive other physical characteristics such as facial and body appearance via, for example, a camera, as well as the genetic composition of the user by means of genetic material gathering procedures, such as blood lancets.

The biometric certificate as shown in FIG. **2** may be generated by processing the registration biometric data from the registration biometric input device **26**, processing the user input data such as a user ID from the user data input device **28**, and processing the public key **30** of the user at a biometric certificate generator **32** of a registration authority **34**. Such input data are processed with the private key **36** of a certifying authority to generate a digital biometric certificate **38** which is sent to the memory for storage and subsequent use to authenticate the first user and associated electronic transactions of the first user.

The registration biometric data **20** to be incorporated into the biometric certificate of FIG. **2** is obtained directly from

the physical characteristics of the subject through the biometric input device **26**. The subject unique ID **18** of the user may include M bits, in which typically M≈50 bits≈6 bytes or less, while the biometric data **20** typically includes much more data than the subject unique ID **18**. Generally, the biometric data **20** has N bits in which N may be very large, such as about 500 bytes. In fact, the amount of the biometric data **20** is unlimited; for example, a fingerprint may be visually scanned to any resolution to obtain key fingerprint aspects which uniquely distinguish fingerprints, or alternatively to obtain data representing pixels of the entire fingerprint. Accordingly, the biometric data **20** may require large amounts of memory for storage such as 2 kB or even 4 MB. Accordingly, in the preferred embodiment, N is much greater than M.

Prior to use of the disclosed biometric certification system and method, the biometric database **66** is built using, for example, a registration process in which individuals are required to provide proof of identity; that is, identification information such as a birth certificate, a driver's license, provided to a registration authority. Once the registration authority is satisfied with such proof, the identification information is entered into the registration system **24** and biometric measurements are then taken concurrently using at least one biometric input device **26**, as shown in FIG. **3**.

Such stored biometric measurements form the pre-stored biometric data in the biometric database **66** which corresponds to the pre-registered individuals who have undergone the registration process described above. Accordingly, pre-registered individuals may be properly authenticated, while unregistered individuals are rejected, within the cross-over error rate.

The biometric certificates **38** are then sent to be stored in a memory, such as a biometric database or a memory of a smart card, as shown as the memory **66** in FIG. **5**. The registration system **24** of FIG. **3** may be located at a central registration station associated with a network, such that the corresponding biometric certificates of a user may be directly and securely stored in the memory **66**, such as a central biometric database of a network or an individual memory of a smart card of the user. Accordingly, the central biometric database as the memory **66** may serve a network of users conducting transactions, such as electronic commerce (E-commerce), over the Internet and other networks. Alternatively, a smart card of the first user having the memory **66** may pre-store the biometric certificates, such that kiosks and other devices such as terminals and automatic teller machines (ATMs) may access the memory **66** and obtain the secured biometric certificate of the first user.

Referring to FIGS. **4–5**, to conduct an electronic transaction, the first user uses the transaction system **40** in FIG. **4**. The first user uses a transaction biometric input device **44** to generate transaction biometric data **46** as contemporaneous biometrics associate with the first user. The first user also generates transaction first data **50** through a transaction data input device **48**. For example, the transaction first data **50** may include selections of products to be purchased over the Internet, or may include electronic funds transfers through an ATM. The transaction first data **50** also includes user ID data identifying the first user and associating the first user with the remainder of the transaction first data.

Both of the transaction biometric data **46** and the transaction first data **50** are sent over the network **60** unchanged and in the clear, or optionally encrypted by additional encryption techniques known in the art, to be received by the transaction reception section **42**, as shown in FIG. **5**.

In addition, at the transaction transmission section **40** of FIG. **4**, both of the transaction biometric data **46** and the transaction first data **50** are processed, for example, using a first hash function **52**, such as a one-way hashing function, to generate a first hashed value. RSA and SHA-1 are examples of public key cryptographic methods and one-way hashing which may be used for such encryption and hashing functions. The RSA method is described, for example, in U.S. Pat. No. 4,405,829 to Rivest et al., which is incorporated herein by reference. The SHA-1 method is described, for example, in U.S. Pat. No. 5,623,545 to Childs et al., which is incorporated herein by reference.

The first hashed value is then sent to a digital signature function **54**, in which the hashed value is signed; that is, encrypted, using the private key **56** of the first user to generate a digital signature **58**, incorporating the first hash value. The digital signature **58** is then sent to the network **60**.

The set of data transmissions constituting the transaction biometric data **46**, the transaction first data **50**, and the digital signature **58** may be sent as separate bitstreams and/or data packets, or otherwise may be sent together by appending the associated data sequences using a concatenator, such as an adder for bitwise adding of the data sequences. In addition, software may be used to append such data. The data **46**, **50**, and **58** may be sent to the network **60**, which may include telephone networks, satellite communications, and/or the Internet.

Referring to FIG. **5**, after receiving the electronic transaction from the network **60**, the receiving section **42** sends the user ID data **62** from the transaction first data **50** to be sent to a biometric certificate extractor **64**. The biometric certificate extractor **64** uses the user ID data **62** to access a corresponding biometric certificate stored in the memory **66**, such as the biometric database or smart card memory. That is, if the first user had previously stored corresponding biometric certificates generated from biometric characteristics of the first user using the registration system **24** shown in FIG. **3**, the biometric certificate of the first user may be indexed according to the user ID data, such as the social security number, of the first user.

The memory **66** may receive the user ID data **62**, or otherwise may receive a command from the biometric certificate extractor **64** to retrieve any biometric certificate corresponding to the user ID data **62** of the first user. If none are available, the receiving section **42** may generate a rejection signal, for example, at the biometric certificate extractor **64**, to indicate that no biometric certificate is available.

Accordingly, any user requesting authentication of an electronic transaction but failing to be registered; that is, to have a corresponding pre-stored biometric certificate stored in the memory **66**, is not authenticated. The receiving section **42** may generate a corresponding message of non-authentication, and may also send such a message through the network **60** to the transmitting section **40** to indicate no authenticity in the transaction.

Otherwise, if a biometric certificate is available for the first user having corresponding user ID data, the biometric certificate **68** is retrieved and sent to the biometric certificate extractor **64** to decrypt the biometric certificate **68** using the public key **70** of the certifying authority. Thus, the biometric certificate extractor **64** obtains the decrypted registration biometric data **72** and the decrypted user public key **74** associated with the first user.

The decrypted user public key **74** is then sent to a decryptor to decrypt the digital signature **58** sent over the

network **60** from the transmitting section **40**. The decryptor **76** then extracts the first hash value which was incorporated into the digital signature **58** by the first hash function **52**.

The receiving section **42** authenticates the first hash value by attempting to recreate the first hash value using a second hash function **78** which is identical to the first hash function **52** of the transmitting section **40**. The second hash function **78** receives the transaction biometric data **46** and the transaction first data **50** from the network **60**, which were sent from the transmitting section **40** in the clear, or optionally encrypted by additional encryption techniques known in the art. The second hash function **78** thus generates a second hash value from the same input data applied to the first hash function **52**.

The first and second hash values are then compared by a first classifier **80**, such as a comparator or matching routines in software, for determining a match between the first and second hash values. A first validation signal **82** is generated to indicate whether or not both independently generated hash values match.

If both match, then the receiving section **42** thus determines that both of the transaction biometric data **46** and the transaction first data **50**, in combination, are authentic and have not been modified during transmission over the network **60**.

In addition, the receiving section **42** determines whether the electronic transaction is indeed from the indicated user corresponding to the transaction biometric data **46**; that is, transaction biometric data **46** may not be authentic, or alternatively, the decrypted user public key **74** may be a public key **74** commonly shared by a specific group of people such as employees of a specific company.

Accordingly, the receiving section **42** compares the biometric data of the first user generated during the transaction, as the transaction biometric data **46**, with the registration biometric data generated at an earlier date from the first user during a registration process using the registration system **24**. The registration biometric data, which is decrypted by the biometric certificate extractor **64** to be the decrypted registration biometric data **72**, is applied to a second classifier **84** to be compared to the transaction biometric data **46** which is sent over the network **60** in the clear, or optionally encrypted by additional encryption techniques known in the art.

The second classifier **84** may be a comparator, or alternatively a software routine or other hardware/software devices implementing data matching techniques, for comparing the biometric data to obtain a decision value. Alternatively, the second classifier **84** may be a trained neural network and/or a fuzzy logic classifier for classifying whether or not, within an error tolerance, the sets of biometric data **46, 72** were obtained from the same individual using biometric input devices. Such classification methods for authentication of images and data sequences using neural networks are described, for example, in U.S. Pat. No. 5,619,620 to Eccles, which is incorporated herein by reference.

The second classifier **84** then generates a decision in the form of a second validation signal **86**, which may be logic values corresponding to YES or NO, or TRUE or FALSE, indicating verification of the authenticity of the user sending the electronic transaction. Alternatively, the authentication decision may be a numerical value, for example, corresponding to a percentage of confidence of authenticity. The second classifier **86** may include a predetermined threshold of, for example, 98% authenticity, to be exceeded in order to proceed with the processing of the electronic transaction.

The receiving section **42** shown in FIG. **5** may respond to the validation signals **82, 86** to process the transaction first data **50**, such as an on-line purchase or an electronic funds transfer. Accordingly, transaction processing systems (not shown) may also be included in the receiving section **42**. Alternatively, the receiving section **42** of FIG. **5** may be coupled to external transaction processing systems.

In another alternative embodiment, the receiving section may include an AND circuit **88** shown in FIG. **5**, such as a logic AND gate or other logic mechanisms, for generating a final validation signal **90** from the validation signals **82, 86**. Accordingly, if and only if both of the classifiers **80, 84** determine that the transaction biometric data **46** as well as the transaction first data **50** have been sufficiently securely transmitted over the network **60**, then a final validation signal **90** reflecting the security of the overall transaction is generated.

Although the first classifier **80** is a perfect classifier; that is, only an exact match of the hash values generates an authentication, the second classifier **84** may generate percentages reflecting relative authenticity and/or scaled numerical values on an authenticity scale to reflect the error tolerance of the second classifier **84** and/or the cross-over error rates associated with biometrics. Accordingly, the application of fuzzy logic may be used to generate a crisp determination of the authenticity of the transaction biometric data **46** as the second validation signal **86**.

Using biometric certificates, cross-over error rates for identification and authentication may be below about 2.0%, and may even be also low as about 0.5%. The application of more advanced biometric input devices **26, 44** and classifiers **80, 84** known in the art may obtain substantially perfect authentication of any individual from the global population.

The disclosed biometric certification system and method may include electronic transactions using a network as described in commonly assigned U.S. patent application Ser. No. 08/770,824, filed Dec. 20, 1996 and entitled "VIRTUAL CERTIFICATE AUTHORITY, which is incorporated herein by reference. Such a system can be adapted to include the use of biometric certificates as described herein for cryptographically binding the biometric data of a user with identification information to form such biometric certificates. The use of public key technology allows the transaction/signature authentication process to be done either centrally or remotely, depending upon the needs of the transaction.

While the disclosed biometric certification system and method is particularly shown and described herein with reference to the preferred embodiments, it is to be understood that various modifications in form and detail may be made therein without departing from the scope and spirit of the present invention. Accordingly, modifications, such as any examples suggested herein, but not limited thereto, are to be considered within the scope of the present invention.

What is claimed is:

1. A method for authenticating an electronic transaction involving a user, comprising the steps of:

registering a user, including the steps of:

receiving a registration set of physical characteristics of the user at a biometric input device;

generating registration biometric data corresponding to the registration set of physical characteristics;

generating a biometric certificate from the registration biometric data, user input data, a public key of the user, and a digital signature; and

storing the biometric certificate in a biometric database;

transmitting an electronic transaction over a network, the electronic transaction including transaction biometric

data, transaction first data, and a digital signature generated from the transaction biometric data and the transaction first data, the step of transmitting including the steps of:

receiving a current set of physical characteristics of the user;

generating the transaction biometric data from the current set related to the physical condition of the user;

generating a first hash value signal from the transaction first data and the transaction biometric data;

generating the digital signature from the hash value and a private key signal of the user;

transmitting the digital signature over the network; and

transmitting the transaction biometric data and the transaction first data over the network; and

authenticating the electronic transaction, including the steps of:

receiving the digital signature, the transaction biometric data and the transaction first data from the network;

retrieving user identification (ID) data from the transaction first data;

retrieving a biometric certificate, corresponding to the user ID data, from the biometric database;

extracting the registration biometric data and the user public key from the biometric certificate;

decrypting the digital signature using the user public key to retrieve the first hash value from the digital signature;

generating a second hash value from the transaction biometric data and the transaction first data;

comparing the first hash value to the second hash value using a first classifier;

generating a first validation signal to authenticate the transmission of the transaction first data and the transaction biometric data based on the comparison by the first classifier;

comparing the registration biometric data and the transaction biometric data using a second classifier; and

generating a second validation signal to authenticate the user based on the comparison by the second classifier.

2. The method of claim **1**, wherein the step of authenticating further comprises the step of:

ANDing the first and second validation signals.

3. The method of claim **1**, wherein the step of receiving a registration set of physical characteristics of the user includes the step of:

receiving visual characteristics of the user using a visual reader as the biometric input device.

4. The method of claim **1**, wherein the step of receiving a registration set of physical characteristics of the user includes the step of:

receiving speech characteristics of the user using a speech digitizer as the biometric input device.

5. The method of claim **1**, wherein the step of generating the registration biometric data includes the step of:

generating a bit sequence greater than about 500 bytes in length as the registration blometric data.

6. A system for authenticating an electronic transaction involving a user, comprising:

a registration section configured to register a user by receiving a registration set of physical characteristics of the user at a biometric input device, generating registration biometric data corresponding to the registration set of physical characteristics, generating a biometric certificate from the registration biometric data, user input data, a public key of the user, and a digital signature, and storing the biometric certificate in a biometric database;

a transmission section configured to transmit an electronic transaction over a network, the electronic transaction including transaction biometric data, transaction first data, and a digital signature generated from the transaction biometric data and the transaction first data, the transmitting section receiving a current set of physical characteristics of the user, generating the transaction biometric data from the current set related to the physical condition of the user, generating a first hash value signal from the transaction first data and the transaction biometric data, generating the digital signature from the hash value and a private key signal of the user, transmitting the digital signature over the network, and transmitting the transaction biometric data and the transaction first data over the network; and

an authentication section configured to authenticate the electronic transaction by receiving the digital signature, the transaction biometric data and the transaction first data from the network, retrieving user identification (ID) data from the transaction first data, retrieving a biometric certificate, corresponding to the user ID data, from the biometric database, extracting the registration biometric data and the user public key from the biometric certificate, decrypting the digital signature using the user public key to retrieve the first hash value from the digital signature, generating a second hash value from the transaction biometric data and the transaction first data, comparing the first hash value to the second hash value using a first classifier, generating a first validation signal to authenticate the transmission of the transaction first data and the transaction biometric data based on the comparison by the first classifier, comparing the registration biometric data and the transaction biometric data using a second classifier, and generating a second validation signal to authenticate the user based on the comparison by the second classifier.

7. The system of claim **6**, wherein the authentication section is further configured to AND the first and second validation signals.

8. The system of claim **6**, wherein the registration section is configured to receive visual characteristics of the user using a visual reader as the biometric input device.

9. The system of claim **6**, wherein the registration section is configured to receive speech characteristics of the user using a speech digitizer as the biometric input device.

10. The system of claim **6**, wherein the registration section is configured to generate a bit sequence greater than approximately 500 bytes in length as the registration biometric data.

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